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COMPLETE SPECIFICATION

Speed and Clutch Controlling Means for Mechanical Power Transmission Mechanism

We, SHELL DEVELOPMENT COMPANY, a corporation organized under the laws of the State of Delaware, United States of America, and having a place of business at 100, Bush Street, San Francisco, California, United States of America, (Assignees of FREDERICK M. CARROLL, of the City of Tulsa, County of Tulsa, State of Oklahoma, United States of America, a citizen of the United States of America), do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to a combination clutch and speed control mechanism, the speed control being effected by means of an engine throttle, electric motor switch or rheostat, or scoop tube or filling valve for a hydraulic coupling. It is applicable to any machinery wherein a combined clutch and speed control are advantageous, such as small marine applications, construction machinery, and construction hoists, and pertains more particularly to a simplified combination control for oil field drawworks, such as are used on well servicing rigs and others.

Well servicing units may be of the portable truck-mounted, skid-mounted, or stationary type, and may, for example, be used for pulling rod and tubing strings, or bailing or swabbing. When truck-mounted, for example, these units may have a collapsible derrick or mast and generally comprise a hoist or drawworks having either a separate prime mover or a power take-off from the truck engine. The drawworks usually includes a counter-shaft driven by a prime mover through a multi-speed transmission and gears, belts, or chains, drive sprockets on the counter-shaft, a drum shaft with either a single sprocket or with high and low speed sprockets, either a single clutch or high and low speed clutches for selectively connecting the desired drum shaft sprocket with the drum shaft, a proper number of drive chains connecting the drum shaft sprockets with the drive sprockets on the countershaft, or with aligned sprockets on a jack shaft, which, in turn, is connected by a drive chain to a line shaft drive sprocket, spring means for disengaging the drum shaft sprocket from the drum shaft when the drum is not being driven by the counter-shaft sprockets, a brake for the drum and the drum shaft, and individual control levers for each of the clutch or clutches, the prime mover speed control, and the multi-speed transmission. With so many controls to operate simultaneously or in rapid succession, it is difficult for the operator to carry out his duties with a maximum of efficiency, since it is necessary for him at the same time to watch the traveling block or the tubing, etc., being hoisted, and the activities of his fellow workmen. Furthermore, the complexity of the controls frequently necessitates their location at a point adjacent the drawworks, and in the case of a hoist mounted on a truck carrying a portable derrick, puts the operator in such a position as to have a limited view of the well head, the crew on the derrick floor, etc.

In certain modern hoist apparatus, a portion of the manual effort and dexterity required of the operator has been eliminated by the use of fluid-operated clutches and fluid-drive transmission mechanisms. Fluid-operated clutches make possible the application to the clutch faces of heavy engaging pressures, giving high torque capacity, which it is frequently impossible to obtain by means of manually operated clutches. Fluid-drive transmission mechanisms, such as fluid clutches and hydraulic torque transformers, permit smooth application of power to the drawworks, greatly reduce shock loads, and eliminate frequent stalls of the prime mover. However, with the type of control now in use, full advantage cannot be taken of the possibilities offered by said clutches and mechanisms.

Although simplified control mechanisms for the operation of the prime mover and the drawworks clutches have already been proposed, these mechanisms have hitherto applied to the operation of only a single clutch, have involved no special features

for taking full advantage of fluid-operated clutches and fluid-drive mechanisms, and have not offered easy simultaneous one-hand control of prime mover speed and clutch operations but have for the most part required considerable physical effort to operate. Moreover, when fluid drives are used, it is advantageous to engage the friction or positive clutches while the prime moved is at idling speed, thus reducing the shock or slip of the engagement to a minimum, after which the throttle is opened. This is a procedure, however, that is foreign to operators accustomed to the use of direct mechanical drives, who would not sense the possibilities offered with the fluid drive, and the tendency is for the operator to accelerate the prime mover considerably before engaging the clutch.

It is, therefore, an object of the present invention to provide a control apparatus applicable to hoist units and, more particularly, to portable oil field rigs wherein one lever controls the throttle of a prime mover and the operation of fluid-actuated-clutches transmitting the power of said prime mover to a drawworks.

It is another object of this invention to provide an easily operated and simplified control mechanism which may be easily arranged in a desirable position relative to the drawworks, derrick and well head.

It is a further object of this invention to provide a control mechanism wherein the operations of clutch engagement and acceleration can be performed only in the sequence desired for optimum performance.

It is still another object of this invention to provide in combination a hoist unit comprising a simplified control mechanism, wherein one lever controls in an enforced operational sequence the throttle of a prime mover provided with a fluid drive and the fluid-operated clutches transmitting the power of said prime mover to a drawworks.

Accordingly the present invention provides in a drawworks mechanism for oil and gas wells, the combination of a driving prime mover unit, a rotatable driven unit, means comprising a pressure fluid operated clutch for transmitting power from said first to said second unit, a rod member adapted for reciprocation along its axis and for rotation about its axis, throttle means operatively connected to said rod member, and responsive to its reciprocating motion for regulating the power of the prime mover, valve means operatively connected to said rod member and responsive to its rotational motion for engaging said clutch by admitting pressure fluid thereto, and single control means connected to one end of said rod member and adapted to reciprocate and to rotate said rod member.

The present invention also provides in a power device including a prime mover, a speed regulator for the prime mover, driven means, and pressure fluid operated clutch means for selectively and operatively connecting the prime mover with the driven means, the improvement comprising a combination control means for the speed regulator and the clutch means, the control means comprising a source of pressure fluid, multiple way valve means for selectively applying the fluid to one unit of the clutch means for engaging the clutch, rod means operatively connected to the speed regulator and the valve means and adapted for reciprocation along its axis and for rotation about its axis, the setting of the speed regulator being responsive to the reciprocating motion of the rod means and the selective setting of the valve means being responsive to the rotational motion of the rod means, and single lever means pivotably connected to the rod means for reciprocating and rotating the rod means, whereby a desired setting of the speed regulator and of the selective clutch valve means may be sequentially operated by a displacement of the single lever.

The present invention further provides in a mechanism including a prime mover, a throttle for the prime mover, driven means, and clutch means for separatively connecting the prime mover with the driven means, the improvement comprising an integrated control means for the throttle and the clutch means, the control means comprising a source of pressure fluid, multiple way valve means for selectively actuating the clutch means into the operative position, rod means operatively connected to the throttle and the valve means and adapted for reciprocation along its axis and for rotation about its axis, the setting of the throttle being responsive to one of the reciprocating motions of the rod means and the selective setting of the valve means being responsive to the other motion of the rod means, and single lever means operatively connected to the rod means for reciprocating and rotating the rod means, whereby a desired setting of the throttle and of the selective clutch valve means may be sequentially operated by a displacement of the single lever.

The invention will now be further described by way of example with reference to the accompanying drawings, in which:

Figure I is a schematic plan view of an embodiment of a draw-works and controls of the present invention;;

Figure II shows an enlarged detail of the four-way valve of the control mechanism, showing the valve in cross-section transverse to the axis of rotation;

Figure III shows an enlarged detail of another embodiment of a four-way valve, showing the valve in cross-section transverse to the axis of rotation;

Figure IV is a side elevation of the handle and associated parts of the control mechanism;

Figure V is a perspective view of the control handle and a slotted plate for controlling the sequence of operations;

Figure VI is a schematic view of a preferred form of hydraulic torque transformer for use with the present invention;

Figure VII is a schematic view in section of a preferred form of fluid-operated clutch for use with the present mechanism.

Figure VIII is a cross-sectional view taken along the line VIII—VIII in Figure VII.

Figure IX is a cross-sectional view taken along the line IX—IX in Figure VII.

Figure X is a perspective view of the control apparatus as arranged for the selective operation of four clutches with combined throttle control.

Figure XI is an enlarged plan view of the throttle-connecting and disconnecting mechanism shown in Figure X.

Figure XII is a sectional elevation of the mechanism shown in Figure XI.

Briefly, the present invention resides in the arrangement of air or other fluid-operated clutches on the drum or other shaft, and one or more multiple-way valves to selectively connect one of said clutches to a pressure fluid source and the remaining clutches to a fluid exhaust line, together with a prime mover, preferably operatively connected to the aforesaid clutches through a fluid drive, and a control handle or lever operatively connected to both the multiple-way valve or valves and the prime mover throttle, as will hereinafter be more fully described.

Referring to Figure I of the drawings, a brief embodiment of the present invention comprises a driving or prime mover unit, such as an internal combustion engine 1 (although a steam or electric unit may also be used) suitably mounted on a skid base or a truck (not shown) and a fluid-drive mechanism 2 directly connected to the engine 1. The speed of the engine is responsive to and is controlled by the throttle or accelerator schematically shown at 56.

The fluid drive unit 2 may be of any suitable design and either of the positive displacement type or the turbo type. Likewise, it may or may not embody torque transformation. A suitable fluid transmission, for example, as schematically illustrated in Figure VI, compactly combines a centrifugal pump impeller 61 and a multiple stage turbine 62, the former connected to the engine 1 by input shaft 63 and the latter to an output shaft 5. The circulating fluid (indicated by dotted lines and arrows) passes alternately through and reacts against the stages of the turbine 62 and the stationary blades 64 mounted in the housing.

The output shaft 5, as shown in Figure I, is operatively connected by means of a chain 6 to a countershaft 7, which carries low and high speed drive sprockets 9 and 10, respectively. These low and high speed sprockets 9 and 10 are, respectively, connected by means of chains 11 and 12 to low and high speed sprockets 13 and 14 rotating freely on a shaft 15 which carries the driven unit, that is, the rope drum 16. The sprockets 13 and 14 are selectively connected to the drum shaft 15 by means of fluid-operated or power-operated clutches, such as air clutches 18 and 19.

While the above description and related drawing set forth only a single embodiment of an oil field hoist, it should be understood that these units frequently comprise a plurality of prime movers, rope drums, and other mechanisms. In addition to the counter and drum shafts, there may be line and jack shafts, double drums, and rotary table drives, involving sometimes eight, ten, or more clutches, some of which may be operated alternatively and some simultaneously. It will be obvious that, by the means hereinafter described, the control system may be extended and adapted to perform all necessary operations on these larger rigs with a single control handle.

The pressure fluid-operted clutch may be any one of a number of types, such as a conventional jaw or friction clutch with operating cylinder attached to the shifting yoke, an inflatable member mounted within a friction drum, or any other suitable type. For example, an air-operated clutch as illustrated schematically in Figures VII, VIII and IX is preferred. The sprocket 13 rotates freely on the drum shaft 15 by means of the bearing 71, but is constrained from longitudinal movement along the shaft. A suitable metal ring 72 is securely fastened to sprocket 13. A circular front plate 73 is solidly keyed to the shaft 15. A drum or dish-shaped member 74 is fitted to the shaft 15 by means of internal gear teeth 76 and a splined section 77 of the shaft 15 in such a manner as to permit limited

axial movement of drum-shaped member 74 along shaft 15, but no relative turning movement between the two. Attached to the outer circumference of front plate 73 is a packing 79 effecting a pressure tight seal between plate 73 and drum 74 despite longitudinal movement of the drum 74. Projecting from the inner face of the drum 74 is a coaxial tubular portion 75 adapted to carry therein a packing 81 which effects a tight seal between the drum 74 and an upset portion 82 of the shaft 15. A friction element 84 made of suitable material such as leather, canvas, compositions thereof, etc. is securely attached to the outer face of the drum 74 in position for selective frictional engagement with metal ring 72. The pressure-tight annular space or chamber 85 thus enclosed between the front plate 73 and drum 74 communicates with the pressure fluid conduit 21 through coaxial bore 87 and radial channel 88 in the drum shaft 15 and a suitable rotary packing gland 90 carried by the conduit 21 and arranged about the outer end of the shaft 15. A plurality of springs 91 circumferentially disposed between the front plate 73 and drum 74 are in tension and tend to keep drum 74 retracted and friction element 84 out of contact with metal ring 72. When, however, through the valve and other mechanism elsewhere described, a fluid, such as any suitable liquid or gas, e.g., compressed air, is injected into the enclosed annular chamber 85 the drum 74 is forced away from the front plate 73 until the friction surface element 84 is firmly in contact with plate ring 72. Thus, torque applied to sprocket 13 is transmitted through frictionally-gripped elements 72 and 84 to drum 74 and thence through the internal gear teeth 76 and splines 77 to shaft 15 as long as pressure is supplied through conduit 21. If this pressure be released through conduit 21, springs 91 retract drum 74, separating elements 72 and 84 and permitting sprocket 13 to rotate freely without affecting shaft 15.

The clutches 18 and 19, as shown in Figure 1, are operated by supplying air or fluid pressure through conduits 21 and 22, respectively, through a four-way valve 23 from a pressure fluid or compressed air line 20 leading from a source of pressure fluid or air. The four-way valve 23, as shown in Figure II, is so arranged that either one of the conduits 21 or 22 may be connected to the pressure line 20 while the other of the conduits 21 or 22, as the case may be, connects with the atmosphere or a low pressure reservoir through an exhaust line 25, whereby only one clutch at a time can be subjected to air or fluid pressure to engage one of the sprockets 13 or 14 with the drum shaft 15. It is also possible through the four-way valve to simultaneously connect both of conduits 21 and 22 to the exhaust conduit 25 while the pressure line 20 remains blocked off. The source of pressure fluid supply from which the pressure line 20 leads may, for example, comprise a compressor 26 (Figure I) operatively connected to the engine by means of a belt 27. An accumulator or surge tank 28 may be provided in the pressure line 20, if desired.

As shown more fully in Figure II, the multiple-way valve, preferably a four-way valve 23, comprises a stationary casing 30 having a bore 31 and radial ports 32, 33, 34 and 35, connecting said bore 31 with the low speed clutch conduit 21, the exhaust line 25, the high speed clutch conduit 22, and the air or pressure fluid line 20, respectively. Closely fitted within the bore 31 of the casing 30 is a rotatable plug 36 having therein passages 37 and 38 adapted to provide selective simultaneous communication between ports 32 and 35, as well as ports 33 and 34; or between ports 34 and 35, as well as ports 32 and 33; or between the three ports 32, 33 and 34, which latter position is a neutral position in which both clutches are exhausted and disengaged. An axial bore 40 through the plug 36 provides a passageway through the valve for a throttle control rod 41. Surrounding the rod and attached coaxially to the valve plug is a tubular member 43.

For some applications on drilling and well-servicing rigs, it is desirable that one or the other of two clutches be at all times engaged. In this case, a four-way valve of a type known as a four-way four-port 90° turn valve, having no neutral position may be used. As shown in Figure III, a suitable valve of this type comprises a stationary casing 130 having a bore 131 and radial ports 132, 133, 134 and 135 connecting said bore 131 with the low speed clutch conduit 21, the exhaust line 25, the high speed clutch conduit 22, and the compressed air line 20, respectively. Closely fitted within the bore 131 of the casing 130 is a rotatable plug 136 having two transverse passages 137 and 138 adapted to provide fluid communication simultaneously between pairs of ports 132 to 135 inclusive. With this type, exhausting of one clutch is simultaneous with pressuring of the other, and it is impossible to disengage one clutch without engaging the other.

The control mechanism, as will be seen from Figures I, IV, and V, comprises a lever 50, one end of which is pivotably connected to the end of the throttle con-

trol rod 41 and the other end is fitted with a handle knob 51. Pivotably attached between the ends of the control lever 50 is the outer end of the horizontal portion of the inverted **L**-shaped extension 52 of a yoke 53 (Figures IV and V) which is attached to the outer end of the tubular valve-operating member 43. It may readily be seen from Figures IV and V that movement of the knob end of the lever 50 in a plane transverse to the axis of the throttle control rod 41, rotates the tubular member 43 and the plug 36 of the four-way valve 23, whereby the clutches 18 and 19 are selectively operated. When the control lever 50 is moved back and forth in a plane through the axis of the throttle control rod 41 the latter is reciprocated, whereby the throttle or accelerator 56 of the engine 1 is actuated.

If desirable, however, the valve 23 need not be coaxial with the operating tubular member 43 but may be offset and the rotary motion transmitted from member 43 to valve 23 by means of suitable sprockets and chain, pulleys and belt, bell cranks and connecting rod, or gears.

In order to secure the aforementioned advantages of enforcing the sequence of operations and compelling the engagement of clutches at idling speed, and positively preventing clutching or declutching at other than idling speeds, there is provided a plate 60 having therein an **E**-shaped slot 61 through which the lever 50 passes and by which the travel of the lever 50 is limited to the desirable position, as shown in Figure V. It is obvious that the engine may be accelerated by moving the lever up through the middle slot of the three parallel slots, but that from this middle slot, no clutch engagement can be effected. On the other hand, either clutch may be selectively engaged, by moving the lever to the slot forming either the top or bottom of the E (marked low and high on plate 60 in Figure V) only after which the throttle may be opened. Thus, clutching and declutching can be performed only with the throttle at a predetermined idle setting, with obvious reduction of clutch slippage and shock.

The above-described embodiment illustrates a method of selectively controlling two clutches. However, if a greater number of clutches are to be selectively controlled, this is accomplished by means of the hereinbelow described embodiment shown in Figures X, XI and XII. A lever 95 having fitted thereon at one end a handle knob 97, is pivotably connected preferably at the other end to rod or tube 96. Pivotably attached between the ends of the control lever 95 is the outer end of the horizontal portion of the inverted **L**-shaped extension 98 of a yoke 99, coaxial with rod or tube 96. Yoke 99 rotates freely about its axis in bearing 100, which is rigidly mounted on a convenient part of the framework (not shown). Collar 101 is cylindrically connected through the interior of bearing 100 to yoke 99 and prevents axial movement of the yoke 99. The movement of the lever 95 is restricted by means of a plate 115 having a multiple-branched slot 116 in the form of a pair of interconnected **E**-shapes, as shown in Figure X. The lever 95 passes through the slot 116 and has several different high and low throttle positions as indicated at *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *j*, and *k*, depending on which clutch, if any, is engaged. Coaxial with rod or tube 96 are four-way valves 105 and 106, which are similar to the valve 23, illustrated in Figure II. However, instead of a rod 41 and a tubular member 43 as in Figure II, to carry out similar functions in valves 105 and 106, there is provided, as shown in Figure X, on rod 96 a feather key 102, operating in co-linear keyways 103 and 104 in valves 105 and 106, respectively. Thus, rod or tube 96 may reciprocate through the bores of valves 105 and 106, but any rotary motion of 96 is transferred to valve 105 or 106, depending on whether key 102 is situated in keyway 103 or keyway 104. The fact that rotary motion of 96 can take place only when lever 95 is in portion *d—a—f* or portion *h—b—j* of slot 116 prevents movement of more than one valve at a time.

On valve 106, conduits 20, 21, 22 and 25 lead to the high pressure fluid supply, to the clutches, and to the exhaust, respectively, in a manner similar to that heretofore set forth in relation to the embodiment shown in Figures I, II, and VII. Conduits 20A, 21A, 22A and 25A fulfill the same functions on an additional pair of clutches. Rod 96 extends on through valves 105 and 106, terminating in plug or plunger 109 (as shown more fully in Figures XI and XII) rigidly attached thereto, as by welding. Plug 109 is provided with a key 141 and is slidably fitted into a tube 110 provided with an end closure 111. A rod 108 rigidly attached to the end closure 111 extends to throttle 56 for controlling its action and thereby the speed of the prime mover. Tube 110 is so mounted as to reciprocate freely along its axis within proper limits, but is restrained from rotary movement in any manner desired such as a key 117 and keyway 118 in an open bearing housing 119 or the like. A portion of the wall of tube 110 is cut out to form a narrow longitudinal slot 112 connecting a pair of wide slots 113 and 114. The slot 112 is adapted to receive the

key 141 carried by the plug 109 and to permit free longitudinal passage of the key 141 from one wide slot 113 to the other wide slot 114. These slots 112, 113, and 114, are preferably arranged in such a way that with control lever 95 in neutral position, for example, as at *a*, the center line of key 41 coincides with the longitudinal center line of the slotted portion of the tube 110. The width of the wide end slots 113 and 114 is such as to permit control lever 95 to move its full required travel in either direction in a plane normal to the axis of rod 96 without tending to impart any rotary motion to tube 110. The length of narrow slot 112 is such that from the transverse center line of wide slot 113 to the corresponding center line of the other wide slot 114 is equal to the distance from the transverse center line of keyway 104 to the corresponding center line of keyway 103 in the valves 106 and 105, respectively. Throttle control rod 108 is normally held retracted away from the control lever by a suitable resilient means, such as a spring (not shown), holding the throttle of the prime mover in idling position. It can easily be seen that should control lever 95 be moved in guide slot 116 from its position *a* to position *b*, key 141 will pass from wide slot 113 through narrow slot 112 and into the other wide slot 114. Then, should lever 95 be further advanced toward position *c*, key 141 must pull tube 110 toward the control handle, thus opening the throttle, while, however, all clutches remain in the neutral position. Should lever 95 be moved in guide slot 116 from position *a* to position *d*, it can be seen that key 102 will rotate the core of valve 106 counterclockwise, admitting fluid into one of the clutches controlled by valve 106. At the same time, key 141 is rotated counter-clockwise into one of the side extensions of slot 113. Then, if lever 95 is moved to position *e*, key 141 must pull back tube 110 and with it rod 108, thereby opening the throttle. The return through guide slot 116 from position *d* to *a* obviously returns both throttle and valve 106 to their original positions. In the same manner, moving the lever 95 in slot 116 from position *a* through position *f* to position *g* produces a clockwise rotation in the core of valve 106 and the same reaction as before of tube 110 and associated parts. Movement of lever 95 through slot 116 to position *b* brings key 102 into valve 105 and key 141 through narrow slot 112 into wide slot 114. While the two keys have moved axially, there has been no movement of either valve nor of the throttle control rod 108. Then, if the lever 95 be moved in slot 116 to position *h*, key 102 will rotate the core of valve 105 in a counter-clockwise direction, admitting fluid to one of the clutches connected to the valve. At the same time, key 141 has rotated counter-clockwise into one of the side extensions of wide slot 114. Movement of the lever 95 in slot 116 toward position *i* then pulls tube 110 and, through rod 108, opens the throttle. Movement of the lever 95 through position *j* to position *k* in slot 116 has a corresponding effect except that the core of the valve 105 is rotated clockwise, admitting fluid into the other clutch connected to valve 105, and the throttle is opened through traction exerted by key 141 in the other side extension of slot 114.

It is obvious to those skilled in the art that by the adding of successive E-shaped slots to guide plate 115, adding successive four-way valves adjacent to valves 105 and 106, lengthening of plug 109 and tube 110, and the addition of alternate wide and narrow slots corresponding to slots 112 and 114, that this system can be extended to effect the control of 6, 8, or more clutches, the number being limited only by the practicable travel of lever 95 in a plane containing the axis of rod or tube 96.

This control mechanism is particularly advantageous when applied to portable well-servicing rigs, since its simplicity allows positioning of the control lever 50 adjacent the bottom of the rig structure or floor of the derrick, and close to the well head. This arrangement, besides substantially simplifying the manipulations performed by the operator, results in improved vision and better communication between the members of the servicing crew, which induces greater safety and efficiency. Since the placing of the operator on the derrick floor and the simplification of his manipulations will enable him to assist in the operations, such as in "breaking out" tubing, it is possible to operate a tubing crew with one less man than is now necessary.

It will be noted that the present system is especially adapted for use in combination with prime-movers provided with hydraulic or electric torque transformers and fluid-operated clutches, since it permits the instantaneous and complete engagement of the clutch at a moment when the throttle of the prime-mover is at a very small opening, which, in a conventional draw-works installation would ordinarily result in stalling the prime-mover.

While the illustrations used have considered the use of internal combustion engines, hoists of the type normally used in oil well servicing, fluid drive between prime-mover and final drive of drum shaft and fluid-operated clutches, it can easily

be seen that various modifications can be made and that this system of control can be applied to eny machinery involving a controllable prime-mover and pressure fluid operated clutch or clutches, that it may be applied to the switch or rheostat control of electric motors, to the throttle control of steam engines, to the scoop tube or filling valve of variable-filling hydraulic couplings, that it may be applied not only to the type of clutch described, but to conventional jaw or friction clutches with fluid power cylinder, inflatable clutches, that it may be applied to machinery with variable-voltage transmission systems in connection with the prime-mover, or with mechanical drive to any machinery with a non-stallable prime-mover, and that it may be adapted to use with any practicable number of clutches through extension of the control means set forth in Figures X, XI and XII. It is furthermore obvious that should simultaneous operation of a number of clutches be desired, that by suitable piping, each of the ports, such as 21 and 22, may be connected to two or more clutches.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In a draw-works mechanism for oil and gas wells, the combination of a driving prime mover unit, a rotatable driven unit, means comprising a pressure fluid operated clutch for transmitting power from said first to said second unit, a rod member adapted for reciprocation along its axis and for rotation about its axis, throttle means operatively connected to said rod member, and responsive to its reciprocating motion for regulating the power of the prime mover, valve means operatively connected to said rod member and responsive to its rotational motion for engaging said clutch by admitting pressure fluid thereto, and single control means connected to one end of said rod member and adapted to reciprocate and to rotate said rod member.

2. A draw-works mechanism according to Claim 1 wherein the driving unit is responsive to the throttle and which also includes a source of pressure fluid, and means comprising a valve for applying the fluid to the clutch to engage the clutch, the rod member being operatively connected to the throttle and the valve and the setting of the throttle and of the valve being responsive respectively to the reciprocating and the rotational motion of the rod member.

3. A draw-works mechanism as claimed in Claim 2 which comprises separate sprocket means each comprising a pressure fluid operated clutch for selectively transmitting power from the first to the second unit at high and low speeds, and means comprising a multiple way valve for selectively applying the fluid to one of the clutches to engage said clutch.

4. A draw-works mechanism as claimed in claim 3 including control means comprising a rod member adapted for reciprocation along its axis and a tubular member surrounding said rod member and adapted for rotation about its axis, one of said members being operatively connected to the throttle of said driving unit and adapted to regulate the setting of said throttle by reciprocating motion, and the other member being operatively connected to said valve and adapted to regulate the selective setting of said valve by rotational motion, and single lever means pivotably attached to the ends of said members for rotating and for reciprocating said members, whereby the throttle and the selectie clutch valve may be sequentially operated by a displacement of the single lever.

5. A draw-works mchanism as claimed in claim 2, including means comprising a torque converter and a pressure fluid operated clutch for transmitting power from the first to the second unit, control means comprising a rod member operatively connected to the throttle and the clutch and adapted for reciprocation along its axis and for rotation about its axis, the setting of said throttle being responsive to the reciprocating motion of said member, and the engagement of the clutch being responsive to the rotational motion of the rod member, and single lever means pivotably connected to the rod member for reciprocating and for rotating the rod member.

6. In a power device including a prime mover, a speed regulator for the prime mover, driven means, and pressure fluid operated clutch means for selectively and operatively connecting the prime mover with the driven means, the improvement comprising a combination control means for the speed regulator and the clutch means, the control means comprising a source of pressure fluid, multiple way valve means for selectively applying the fluid to one unit of the clutch means for engaging the clutch, rod means operatively connected to the speed regulator and the valve means and adapted for reciprocation along its axis and for rotation about its axis, the setting of the speed regulator being responsive to the reciprocating motion of the rod means and the selective setting of the valve means being responsive to the rotational motion of the rod means, and single lever means pivotably

connected to the rod means for reciprocating and rotating the rod means, whereby a desired setting of the speed regulator and of the selective clutch valve means may be sequentially operated by a displacement of the single lever.

7. In a mechanism including a prime mover, a throttle for the prime mover, driven means, and clutch means for separatively connecting the prime mover with the driven means, the improvement comprising an integrated control means for the throttle and the clutch means, the control means comprising a source of pressure fluid, multiple way valve means for selectively actuating the clutch means into the operative position, rod means operatively connected to the throttle and the valve means and adapted for reciprocation along its axis and for rotation about its axis, the setting of the throttle being responsive to one of the motions of the rod means and the selective setting of the valve means being responsive to the other motion of the rod means, and single lever means operatively connected to the rod means for reciprocating and rotating the rod means, whereby a desired setting of the throttle and of the selective clutch valve means may be sequentially operated by a displacement of the single lever.

8. A mechanism as claimed in claim 7 wherein the setting of the throttle is responsive to the reciprocating motion of the rod means, and the selective setting of the valve means is responsive to the rotational motion of the rod means.

9. A mechanism as claimed in claim 7 or 8 which also includes guide means for restricting the movement of the lever means in predetermined directional paths, whereby a desired setting of the throttle and of the selective clutch valve means may be effected in a predetermined enforced sequence by a displacement of the single lever along the predetermined directional paths.

10. A mechanism as claimed in claim 7 or 9 comprising a plurality of pressure fluid operated clutches for selectively and operatively connecting the prime mover with the driven means for transmission of power at predetermined speed ranges, wherein the integrated control means for the throttle and the clutches comprises a four-way valve for each pair of clutches for selectively applying the fluid to one of said clutches to actuate the clutch into the operative position, a rod member adapted for reciprocation along its axis and for rotation about its axis, selective means operatively connecting the rod member to the throttle, the selective means having a neutral position allowing a limited free reciprocation of the rod member without affecting the selective means and the throttle, engaging means on the rod member for operatively connecting the member with a valve when the rod member is axially moved while in neutral position in relation to the throttle selective connecting means, the setting of the throttle being responsive to the reciprocating motion of the selective throttle connecting means, the selective setting of each of the valves being responsive to the rotational motion of the rod member when operatively connected thereto, and single lever means opratively connected to the rod member, whereby a desired setting of the throttle and of a selective clutch valve may be effected by a displacement of said single lever.

11. A mechanism as claimed in claim 9 wherein the guide means comprises a stationary slotted plate through which the lever means passes, the slot therein having substantially an **E**-shape.

12. In a power mechanism, the combination of a variable speed driving unit, speed regulator means for said driving unit, a rotatable driven unit, separate means each comprising a pressure fluid operated clutch for transmitting power from the first to the second unit at different speed ratios, a source of pressure fluid, means comprising a multiple way valve for selectively applying the fluid to one of the clutches to engage the clutch, a rod member operatively connected to the speed regulator means and to the valve means and adapted for reciprocation along its axis and for rotation about its axis, the setting of one of the means being responsive to the reciprocating motion, and the setting of the other means being responsive to the rotational motion of the rod member, and single control means connected to one end of the rod member and adapted to reciprocate and to rotate the rod member.

13. A mechanism as claimed in claim 9 or 11 which includes a speed regulator for the prime mover, the guide means restricting the movement of the lever to a fixd path, whereby a desired setting of the speed regulator and valve means may be effected in an enforced sequence by a displacement of the single lever along said fixed path.

14. A speed and clutch controlling means for mechanical power transmission mechanism substantially as described.

Dated this 27th day of April, 1943.

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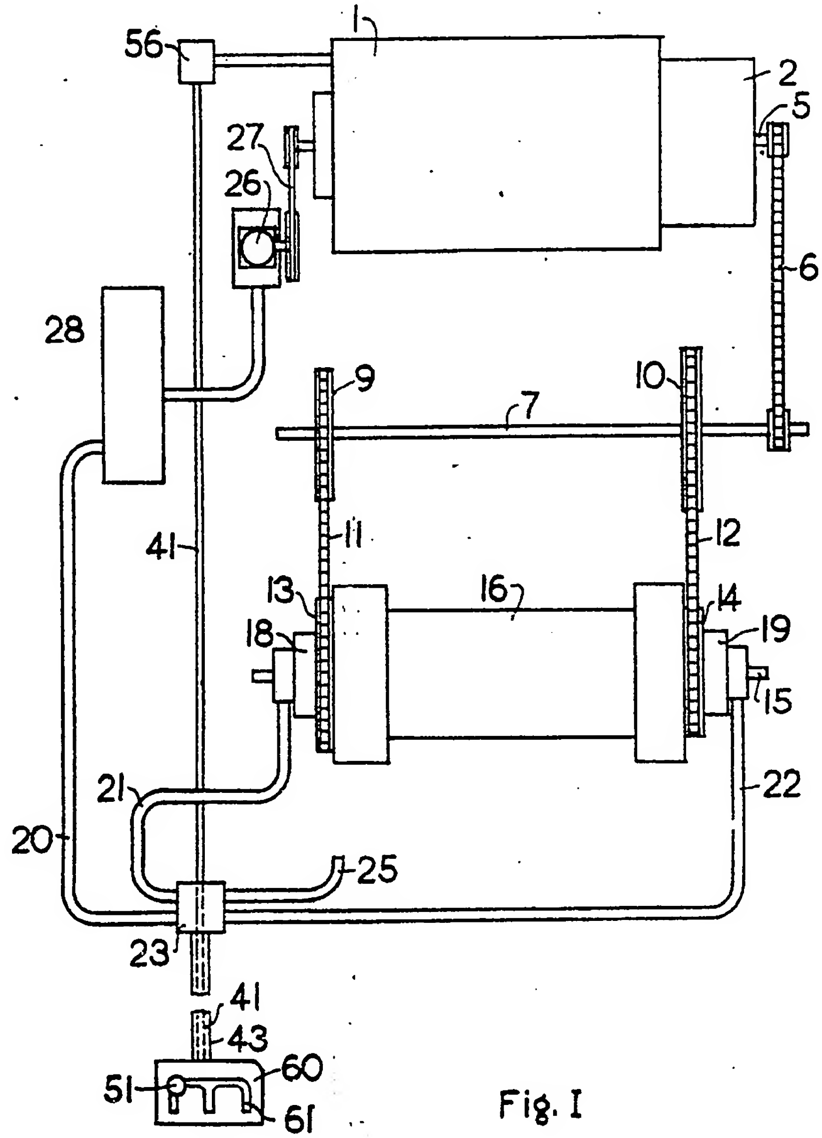

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Fig. I

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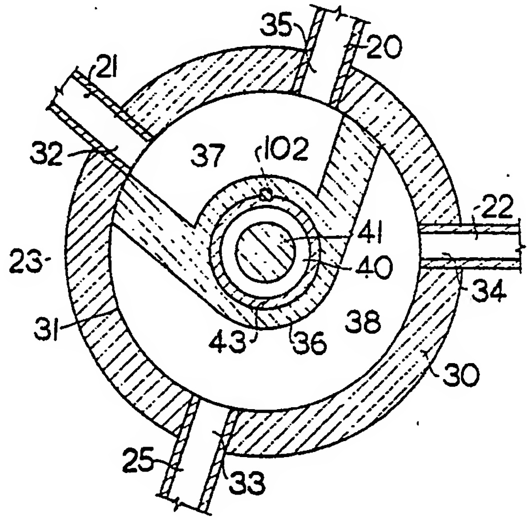

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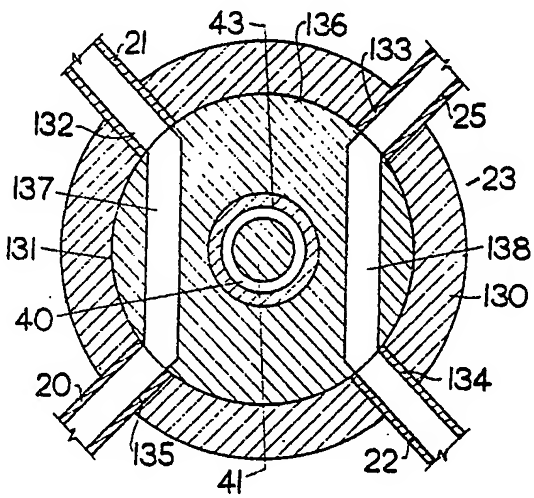

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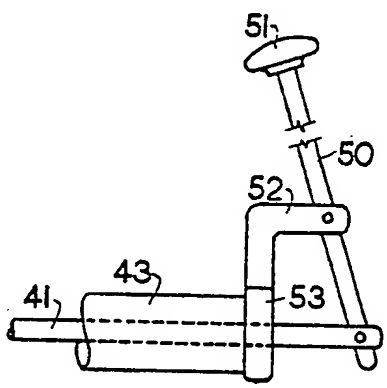

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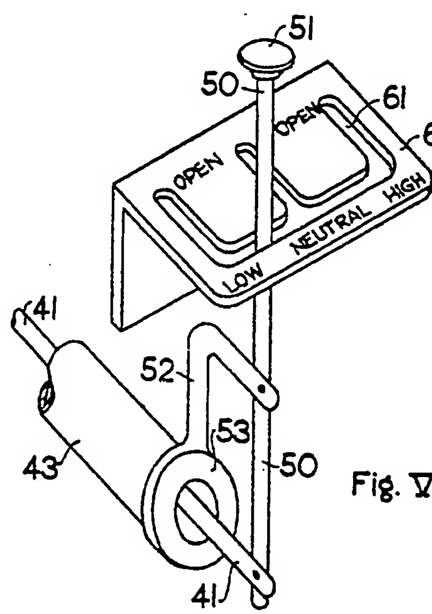

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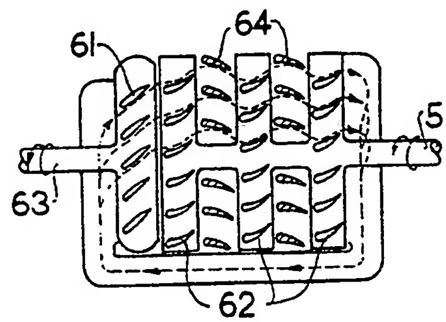

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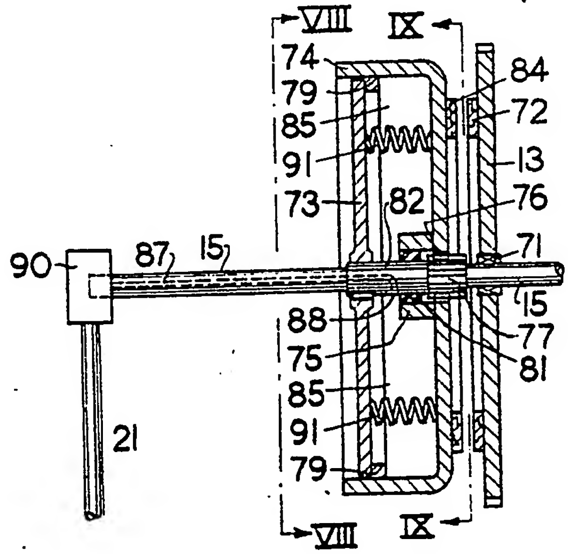

Fig. VII

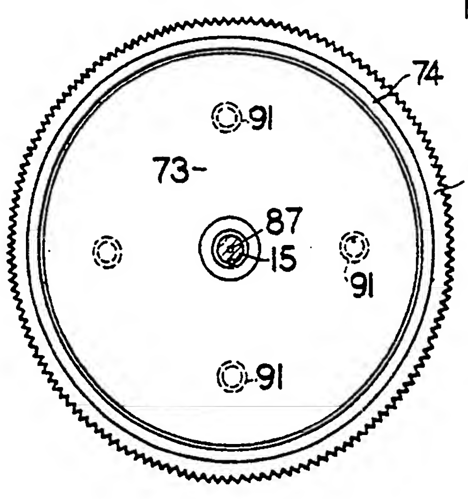

Fig. VIII

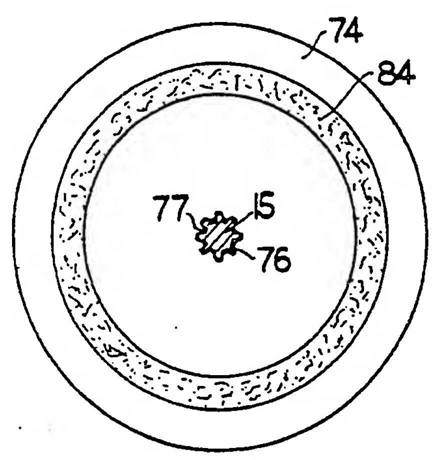

Fig. IX

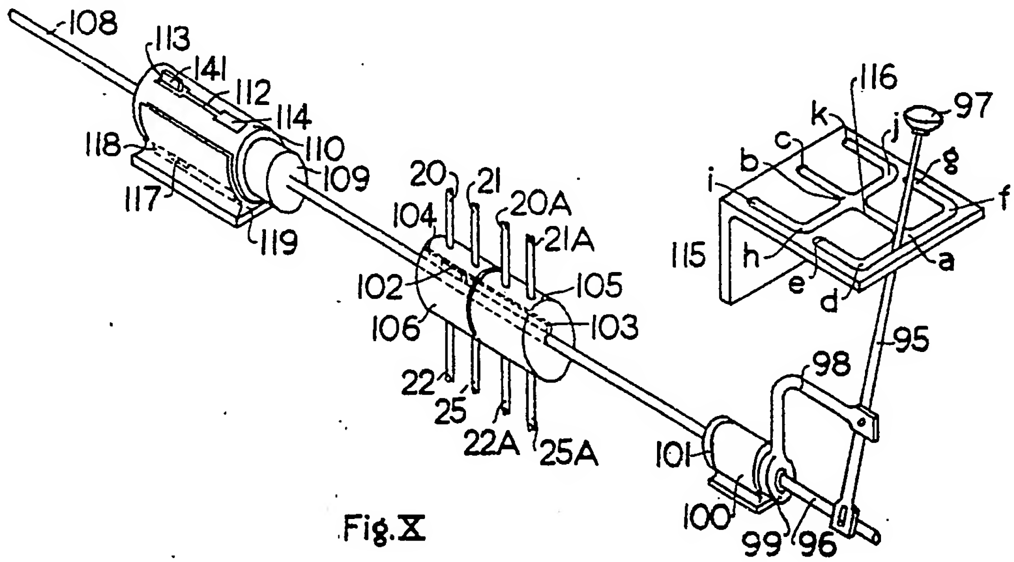

Fig. X

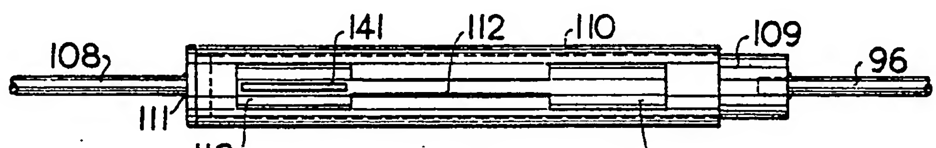

Fig. XI

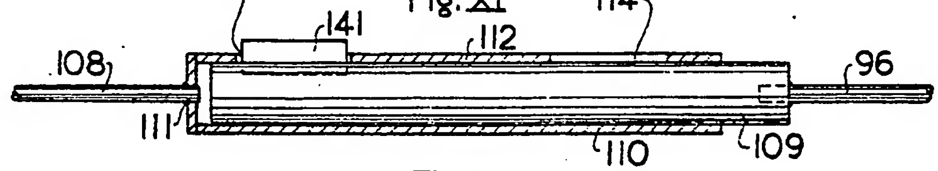

Fig. XII